

08/04/98  
JCS59 U.S. PTO

Attorney's Docket No. DVL-003PAT

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Box Patent Application  
Assistant Commissioner for Patents  
Washington, D.C. 20231

JCS605 U.S. PTO  
09/128753  
08/04/98

NEW APPLICATION TRANSMITTAL

Transmitted herewith for filing is the patent application of  
Inventor(s): Donald V. Lightcap Jr.

Mark F. Smith

**WARNING:** Patent must be applied for in the name(s) of all of the actual inventor(s). 37 CFR 1.41(a) and 1.53(b).

For (title): COMPOSITION, METHOD, AND APPARATUS FOR PROTECTING  
PLANTS FROM INJURY CAUSED BY FROST OR FREEZING  
TEMPERATURES

CERTIFICATION UNDER 37 CFR 1.10

I hereby certify that this New Application Transmittal and the documents referred to as enclosed therein are being deposited with the United States Postal Service on this date Aug 4, 1998 in an envelope as "Express Mail Post Office to Addressee" Mailing Label Number EH58413062405, addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

Mark F. Smith

(type or print name of person mailing paper)

*Mark F. Smith*

Signature of person mailing paper

NOTE: Each paper or fee referred to as enclosed herein has the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 CFR 1.10(b).

**WARNING:** Certificate of mailing (first class) or facsimile transmission procedures of 37 CFR 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.

## 1. Type of Application

This new application is for a(n)

(check one applicable item below)

- ☒ Original (nonprovisional)
- ☐ Design
- ☐ Plant

**WARNING:** Do not use this transmittal for a completion in the U.S. of an International Application under 35 U.S.C. 371(c)(4), unless the International Application is being filed as a divisional, continuation or continuation-in-part application.

**WARNING:** Do not use this transmittal for the filing of a provisional application.

**NOTE:** If one of the following 3 items apply, then complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF A PRIOR U.S. APPLICATION CLAIMED and a NOTIFICATION IN PARENT APPLICATION OF THE FILING OF THIS CONTINUATION APPLICATION.

- ☐ Divisional.
- ☐ Continuation.
- ☐ Continuation-in-part (C-I-P).

## 2. Benefit of Prior U.S. Application(s) (35 U.S.C. 119(e), 120, or 121)

**NOTE:** If the new application being transmitted is a divisional, continuation or a continuation-in-part of a parent case, or where the parent case is an International Application which designated the U.S., or benefit of a prior provisional application is claimed, then check the following item and complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

**WARNING:** If an application claims the benefit of the filing date of an earlier filed application under 35 U.S.C. 120, 121 or 365(c), the 20-year term of that application will be based upon the filing date of the earliest U.S. application that the application makes reference to under 35 U.S.C. 120, 121 or 365(c). (35 U.S.C. 154(a)(2) does not take into account, for the determination of the patent term, any application on which priority is claimed under 35 U.S.C. 119, 365(a) or 365(b).) For a c-i-p application, applicant should review whether any claim in the patent that will issue is supported by an earlier application and, if not, the applicant should consider canceling the reference to the earlier filed application. The term of a patent is not based on a claim-by-claim approach. See Notice of April 14, 1995, 60 Fed. Reg. 20,195, at 20,205.

**WARNING:** When the last day of pendency of a provisional application falls on a Saturday, Sunday, or Federal holiday within the District of Columbia, any nonprovisional application claiming benefit of the provisional application **must** be filed prior to the Saturday, Sunday, or Federal holiday within the District of Columbia. See 37 C.F.R. § 1.78(a)(3).

- ☒ The new application being transmitted claims the benefit of prior U.S. application(s) and enclosed are ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

## 3. Papers Enclosed That Are Required for Filing Date under 37 CFR 1.53(b) (Regular) or 37 CFR 1.153 (Design) Application

- 17 Pages of specification
- 7 Pages of claims
- 1 Pages of Abstract
- 5 Sheets of drawing
- ☐ formal
- ☒ informal

**WARNING:** **DO NOT** submit original drawings. A high quality copy of the drawings should be supplied when filing a patent application. The drawings that are submitted to the Office must be on strong, white, smooth, and non-shiny paper and meet the standards according to § 1.84. If corrections to the drawings are necessary, they should be made to the original drawing and a high-quality copy of the corrected original drawing then submitted to the Office. Only one copy is required or desired. Comments on proposed new 37 CFR 1.84. Notice of March 9, 1988 (1990 O.G. 57-62).

**NOTE:** "Identifying indicia, if provided, should include the application number or the title of the invention, inventor's name, docket number (if any), and the name and telephone number of a person to call if the Office is unable to match the drawings to the proper application. This information should be placed on the back of each sheet of drawing a minimum distance of 1.5 cm. (5/8 inch) down from the top of the page." 37 C.F.R. 1.84(c)).

(complete the following, if applicable)

- ☐ The enclosed drawing(s) are photograph(s), and there is also attached a "PETITION TO ACCEPT PHOTOGRAPH(S) AS DRAWING(S)." 37 C.F.R. 1.84(b).

**4. Additional papers enclosed**

- ☐ Preliminary Amendment
- ☒ Information Disclosure Statement (37 CFR 1.98)
- ☒ Form PTO-1449
- ☐ Citations
- ☐ Declaration of Biological Deposit
- ☐ Submission of "Sequence Listing," computer readable copy and/or amendment pertaining thereto for biotechnology invention containing nucleotide and/or amino acid sequence.
- ☐ Authorization of Attorney(s) to Accept and Follow Instructions from Representative
- ☐ Special Comments
- ☐ Other

**5. Declaration or oath**

- ☒ Enclosed
- Executed by

(check all applicable boxes)

- ☒ inventor(s).
- ☐ legal representative of inventor(s).  
37 CFR 1.42 or 1.43.
- ☐ joint inventor or person showing a proprietary interest on behalf of inventor who refused to sign or cannot be reached.
- ☐ This is the petition required by 37 CFR 1.47 and the statement required by 37 CFR 1.47 is also attached. See item 13 below for fee.
- ☐ Not Enclosed.

**WARNING:** Where the filing is a completion in the U.S. of an International Application, but where a declaration is not available, or where the completion of the U.S. application contains subject matter in addition to the International Application, the application may be treated as a continuation or continuation-in-part, as the case may be, utilizing ADDED PAGE FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION CLAIMED.

- ☐ Application is made by a person authorized under 37 CFR 1.41(c) on behalf of all the above named inventor(s).

*(The declaration or oath, along with the surcharge required by 37 CFR 1.16(e) can be filed subsequently).*

NOTE: It is important that all the correct inventor(s) are named for filing under 37 CFR 1.41(c) and 1.53(b).

- ☐ Showing that the filing is authorized.  
(not required unless called into question. 37 CFR 1.41(d))

## 6. Inventorship Statement

**WARNING:** If the named inventors are each not the inventors of all the claims an explanation, including the ownership of the various claims at the time the last claimed invention was made, should be submitted.

The inventorship for all the claims in this application are:

- ☒ The same.

or

- ☐ Not the same. An explanation, including the ownership of the various claims at the time the last claimed invention was made,  
☐ is submitted.  
☐ will be submitted.

## 7. Language

NOTE: An application including a signed oath or declaration may be filed in a language other than English. A verified English translation of the non-English language application and the processing fee of \$130.00 required by 37 CFR 1.17(k) is required to be filed with the application, or within such time as may be set by the Office. 37 CFR 1.52(d).

NOTE: A non-English oath or declaration in the form provided or approved by the PTO need not be translated. 37 CFR 1.69(b).

- ☒ English  
☐ Non-English  
☐ The attached translation is a verified translation. 37 CFR 1.52(d).

## 8. Assignment

- ☐ An assignment of the invention to \_\_\_\_\_  
\_\_\_\_\_  
☐ is attached. A separate ☐ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or ☐ FORM PTO 1595 is also attached.  
☐ will follow.

NOTE: "If an assignment is submitted with a new application, send two separate letters—one for the application and one for the assignment." Notice of May 4, 1990 (1114 O.G. 77-78).

**WARNING:** A newly executed "CERTIFICATE UNDER 37 CFR 3.73(b)" must be filed when a continuation-in-part application is filed by an assignee. Notice of April 30, 1993, 1150 O.G. 62-64.

## 9. Certified Copy

Certified copy(ies) of application(s)

|         |            |       |
|---------|------------|-------|
| country | appln. no. | filed |
| country | appln. no. | filed |
| country | appln. no. | filed |

from which priority is claimed

☐ is (are) attached.

☐ will follow.

NOTE: The foreign application forming the basis for the claim for priority must be referred to in the oath or declaration. 37 CFR 1.55(a) and 1.63.

NOTE: This item is for any foreign priority for which the application being filed directly relates. If any parent U.S. application or International Application from which this application claims benefit under 35 U.S.C. 120 is itself entitled to priority from a prior foreign application, then complete item 18 on the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

## 10. Fee Calculation (37 CFR 1.16)

A. ☒ Regular application

| CLAIMS AS FILED   |              |                           |                             |
|---|--------------|---------------------------|-----------------------------|
| Number filed  | Number Extra | Rate                      | Basic Fee<br>37 CFR 1.16(a) |
|   |              |                           | <del>\$750.00</del> 790.00  |
| Total   |              |                           |                             |
| Claims (37 CFR 1.16(c)) 34 - 20 = 14                    | ×            | \$ 22.00                  | 308.00                      |
| Independent   |              |                           |                             |
| Claims (37 CFR 1.16(b)) 4 - 3 = 1                       | ×            | <del>\$ 82.00</del> 82.00 | 82.00                       |
| Multiple dependent claim(s),<br>if any (37 CFR 1.16(d)) | +            | <del>270.00</del> 270.00  | 0.00                        |

☐ Amendment cancelling extra claims enclosed.

☐ Amendment deleting multiple-dependencies enclosed.

☐ Fee for extra claims is not being paid at this time.

NOTE: If the fees for extra claims are not paid on filing they must be paid or the claims cancelled by amendment, prior to the expiration of the time period set for response by the Patent and Trademark Office in any notice of fee deficiency. 37 CFR 1.16(d).

Filing Fee Calculation

\$ 1180.00

- B. ☐ Design application  
(\$310.00—37 CFR 1.16(f))

Filing Fee Calculation

\$ \_\_\_\_\_

- C. ☐ Plant application  
(\$510.00—37 CFR 1.16(g))

Filing fee calculation

\$ \_\_\_\_\_

**11. Small Entity Statement(s)**

- ☐ Verified Statement(s) that this is a filing by a small entity under 37 CFR 1.9 and 1.27 is (are) attached.

**WARNING:** "Status as a small entity in one application or patent does not affect any other application or patent, including applications or patents which are directly or indirectly dependent upon the application or patent in which the status has been established. A nonprovisional application claiming benefit under 35 U.S.C. 119(e), 120, 121 or 365(c) of a prior application may rely on a verified statement filed in the prior application if the nonprovisional application includes a reference to a verified statement in the prior application or includes a copy of the verified statement filed in the prior application if status as a small entity is still proper and desired." 37 C.F.R. § 1.28(a).

(complete the following, if applicable)

- ☒ Status as a small entity was claimed in prior application  
60 / 054,846, filed on 08/06/97, from which benefit  
is being claimed for this application under:

- 35 U.S.C. ☒ 119(e),  
☐ 120,  
☐ 121,  
☐ 365(c),

and which status as a small entity is still proper and desired.

- ☐ A copy of the verified statement in the prior application is included.

Filing Fee Calculation (50% of A, B or C above)

\$ 590.00

**NOTE:** Any excess of the full fee paid will be refunded if a verified statement and a refund request are filed within 2 months of the date of timely payment of a full fee. The two-month period is not extendable under § 1.136. 37 CFR 1.28(a).

**12. Request for International-Type Search (37 CFR 1.104(d))**

(complete, if applicable)

- ☐ Please prepare an international-type search report for this application at the time when national examination on the merits takes place.

**13. Fee Payment Being Made at This Time**

☐ Not Enclosed

☐ No filing fee is to be paid at this time.  
(This and the surcharge required by 37 CFR 1.16(e) can be paid subsequently.)

☒ Enclosed

☒ Basic filing fee \$ 590.00

☐ Recording assignment  
(\$40.00; 37 CFR 1.21(h))  
(See attached "COVER SHEET FOR  
ASSIGNMENT ACCOMPANYING NEW  
APPLICATION".) \$ \_\_\_\_\_

☐ Petition fee for filing by other than all the  
inventors or person on behalf of the inventor  
where inventor refused to sign or cannot be  
reached.  
(\$130.00; 37 CFR 1.47 and 1.17(h)) \$ \_\_\_\_\_

☐ For processing an application with a  
specification in  
a non-English language. (\$130.00; 37 CFR  
1.52(d) and 1.17(k)) \$ \_\_\_\_\_

☐ Processing and retention fee  
(\$130.00; 37 CFR 1.53(d) and 1.21(l)) \$ \_\_\_\_\_

☐ Fee for international-type search report  
(\$40.00; 37 CFR 1.21(e)) \$ \_\_\_\_\_

**NOTE:** 37 CFR 1.21(l) establishes a fee for processing and retaining any application that is abandoned for failing to complete the application pursuant to 37 CFR 1.53(d) and this, as well as the changes to 37 CFR 1.53 and 1.78, indicate that in order to obtain the benefit of a prior U.S. application, either the basic filing fee must be paid, or the processing and retention fee of § 1.21(l) must be paid, within 1 year from notification under § 53(d).

Total fees enclosed \$ 590.00

**14. Method of Payment of Fees**

☒ Check in the amount of \$ 590.00

☐ Charge Account No. \_\_\_\_\_ in the amount of \$ \_\_\_\_\_.  
A duplicate of this transmittal is attached.

**NOTE:** Fees should be itemized in such a manner that it is clear for which purpose the fees are paid. 37 CFR 1.22(b).

## 15. Authorization to Charge Additional Fees

**WARNING:** If no fees are to be paid on filing, the following items should not be completed.

**WARNING:** Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges, if extra claim charges are authorized.

- ☐ The Commissioner is hereby authorized to charge the following additional fees by this paper and during the entire pendency of this application to Account No. \_\_\_\_\_:

- ☐ 37 CFR 1.16(a), (f) or (g) (filing fees)  
☐ 37 CFR 1.16(b), (c) and (d) (presentation of extra claims)

**NOTE:** Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 CFR 1.16(d)), it might be best not to authorize the PTO to charge additional claim fees, except possibly when dealing with amendments after final action.

- ☐ 37 CFR 1.16(e) (surcharge for filing the basic filing fee and/or declaration on a date later than the filing date of the application)  
☐ 37 CFR 1.17 (application processing fees)

**WARNING:** While 37 CFR 1.17(a), (b), (c) and (d) deal with extensions of time under § 1.136(a), this authorization should be made only with the knowledge that: "Submission of the appropriate extension fee under 37 C.F.R. 1.136(a) is to no avail unless a request or petition for extension is filed." (Emphasis added). Notice of November 5, 1985 (1060 O.G. 27).

- ☐ 37 CFR 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 CFR 1.311(b))

**NOTE:** Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 CFR 1.311(b).

**NOTE:** 37 CFR 1.28(b) requires "Notification of any change in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying, . . . issue fee." From the wording of 37 CFR 1.28(b): (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

## 16. Instructions as to Overpayment

- ☐ Credit Account No. \_\_\_\_\_  
☒ Refund

Reg. No. 32,437

Tel. No. ( 513 ) 891-6077



SIGNATURE OF ATTORNEY

Mark F. Smith

(type or print name of attorney)

Smith, Brandenburg, Freese & Knoche]mann

P.O. Address

10921 Reed Hartman Highway, Ste 229  
Cincinnati, Ohio 45241

(Application Transmittal [4-1]—page 8 of 9)



**■ Incorporation by reference of added pages**

*(check the following item if the application in this transmittal claims the benefit of prior U.S. application(s) (including an international application entering the U.S. stage as a continuation, divisional or C-I-P application) and complete and attach the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED)*

- Plus Added Pages for New Application Transmittal Where Benefit of Prior U.S. Application(s) Claimed**

Number of pages added 5

- ☐ Plus Added Pages for Papers Referred to in Item 4 Above

Number of pages added \_\_\_\_\_

- ☐ Plus "Assignment Cover Letter Accompanying New Application"

Number of pages added \_\_\_\_\_

**☐ Statement Where No Further Pages Added**

*(if no further pages form a part of this Transmittal, then end this Transmittal with this page and check the following item.)*

- ☐ This transmittal ends with this page.

**ADDED PAGES FOR APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED**

NOTE: "In order for an application to claim the benefit of a prior filed copending national application, the prior application must name as an inventor at least one inventor named in the later filed application and disclose the named inventor's invention claimed in at least one claim of the later filed application in the manner provided by the first paragraph of 35 U.S.C. 112." 37 CFR 1.78(a).

NOTE: "In addition the prior application must be (1) complete as set forth in § 1.51, or (2) entitled to a filing date as set forth in § 1.53(b) and include the basic filing fee set forth in § 1.16; or (3) entitled to a filing date as set forth in § 1.53(b) and have paid therein the processing and retention fee set forth in § 1.21(f) within the time period set forth in § 1.53(d)." 37 CFR 1.78(a).

**17. Relate Back**

**WARNING:** If an application claims the benefit of the filing date of an earlier filed application under 35 U.S.C. 120, 121 or 365(c), the 20-year term of that application will be based upon the filing date of the earliest U.S. application that the application makes reference to under 35 U.S.C. 120, 121 or 365(c). (35 U.S.C. 154(a)(2) does not take into account, for the determination of the patent term, any application on which priority is claimed under 35 U.S.C. 119, 365(a) or 365(b).) For a c-i-p application, applicant should review whether any claim in the patent that will issue is supported by an earlier application and, if not, the applicant should consider canceling the reference to the earlier filed application. The term of a patent is not based on a claim-by-claim approach. See Notice of April 14, 1995, 60 Fed. Reg. 20,195, at 20,205.

(complete the following, if applicable)

☐ Amend the specification by inserting, before the first line, the following sentence:

**A. 35 U.S.C. 119(e)**

NOTE: "Any nonprovisional application claiming the benefit of one or more prior filed copending provisional applications must contain or be amended to contain in the first sentence of the specification following the title a reference to each such prior provisional application, identifying it as a provisional application, and including the provisional application number (consisting of series code and serial number)." 37 C.F.R. § 1.78(a)(4).

☒ "This application claims the benefit of U.S. Provisional Application(s) No(s).:

**APPLICATION NO(S).:**

60 / 054,846  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**FILING DATE**

08/06/97 "  
\_\_\_\_\_  
\_\_\_\_\_

**B. 35 U.S.C. 120, 121 and 365(c)**

**NOTE:** "Any nonprovisional application claiming the benefit of one or more prior filed copending nonprovisional applications or international applications designating the United States of America must contain or be amended to contain in the first sentence of the specification following the title a reference to each such prior application, identifying it by application number (consisting of the series code and serial number) or international application number and international filing date and indicating the relationship of the applications. Cross-references to other related applications may be made when appropriate. (See § 1.14(b))." 37 C.F.R. § 1.78(2).

- ☐ "This application is a
- ☐ continuation
  - ☐ continuation-in-part
  - ☐ divisional

of copending application(s)

- ☐ application number 0 / \_\_\_\_\_ filed on \_\_\_\_\_"
- ☐ International Application \_\_\_\_\_ filed on \_\_\_\_\_ and which designated the U.S."

**NOTE:** The proper reference to a prior filed PCT application that entered the U.S. national phase is the U.S. serial number and the filing date of the PCT application that designated the U.S.

**NOTE:** (1) Where the application being transmitted adds subject matter to the International Application, then the filing can be as a continuation-in-part or (2) if it is desired to do so for other reasons then the filing can be as a continuation.

- ☐ "The nonprovisional application designated above, namely application \_\_\_\_\_ / \_\_\_\_\_, filed \_\_\_\_\_, claims the benefit of U.S. Provisional Application(s) No(s).:

**APPLICATION NO(S).:**

**FILING DATE**

|               |         |
|---------------|---------|
| _____ / _____ | _____ " |
| _____ / _____ | _____ " |
| _____ / _____ | _____ " |

**NOTE:** The deadline for entering the national phase in the U.S. for an international application was clarified in the Notice of April 28, 1987 (1079 O.G. 32 to 46) as follows:

"The Patent and Trademark Office considers the International application to be pending until the 22nd month from the priority date if the United States has been designated and no Demand for International Preliminary Examination has been filed prior to the expiration of the 19th month from the priority date and until the 32nd month from the priority date if a Demand for International Preliminary Examination which elected the United States of America has been filed prior to the expiration of the 19th month from the priority date, provided that a copy of the international application has been communicated to the Patent and Trademark Office within the 20 or 30 month period respectively. If a copy of the international application has not been communicated to the Patent and Trademark Office within the 20 or 30 month period respectively, the international application becomes abandoned as to the United States 20 or 30 months from the priority date respectively. These periods have been placed in the rules as paragraph (h) of § 1.494 and paragraph (i) of § 1.495. A continuing application under 35 U.S.C. 365(c) and 120 may be filed anytime during the pendency of the international application."

### 18. Relate Back—35 U.S.C. 119 Priority Claim for Prior Application

The prior U.S. application(s), including any prior International Application designating the U.S., identified above in item 17B, in turn itself claim(s) foreign priority(ies) as follows:

| country | appln. no. | filed on |
|---------|------------|----------|
|---------|------------|----------|

The certified copy(ies) has (have)

- ☐ been filed on \_\_\_\_\_, in prior application 0 / \_\_\_\_\_, which was filed on \_\_\_\_\_.
- ☐ is (are) attached.

**WARNING:** *The certified copy of the priority application that may have been communicated to the PTO by the International Bureau may **not** be relied on without any need to file a certified copy of the priority application in the continuing application. This is so because the certified copy of the priority application communicated by the International Bureau is placed in a folder and is not assigned a U.S. serial number unless the national stage is entered. Such folders are disposed of if the national stage is not entered. Therefore, such certified copies may not be available if needed later in the prosecution of a continuing application. An alternative would be to physically remove the priority documents from the folders and transfer them to the continuing application. The resources required to request transfer, retrieve the folders, make suitable record notations, transfer the certified copies, enter and make a record of such copies in the Continuing Application are substantial. Accordingly, the priority documents in folders of international applications that have not entered the national stage may not be relied on. Notice of April 28, 1987 (1079 O.G. 32 to 46).*

### 19. Maintenance of Copendency of Prior Application

**NOTE:** *The PTO finds it useful if a copy of the petition filed in the prior application extending the term for response is filed with the papers constituting the filing of the continuation application. Notice of November 5, 1985 (1060 O.G. 27).*

- A.** ☐ Extension of time in prior application

*(This item **must** be completed and the papers filed in the prior application, if the period set in the prior application has run.)*

- ☐ A petition, fee and response extends the term in the pending **prior** application until \_\_\_\_\_.
- ☐ A **copy** of the petition filed in prior application is attached.

- B.** ☐ Conditional Petition for Extension of Time in Prior Application

*(complete this item, if previous item not applicable)*

- ☐ A conditional petition for extension of time is being filed in the pending **prior** application.
- ☐ A **copy** of the conditional petition filed in the prior application is attached.

## 20. Further Inventorship Statement Where Benefit of Prior Application(s) Claimed

NOTE: "If the continuation, continuation-in-part, or divisional application is filed by less than all the inventors named in the prior application a statement **must** accompany the application when filed requesting deletion of the names of the person or persons who are not inventors of the invention being claimed in the continuation, continuation-in-part, or divisional application." 37 CFR 1.62(a) [emphasis added]. (dealing with the file wrapper continuation situation).

NOTE: "In the case of a continuation-in-part application which adds and claims additional disclosure by amendment, an oath or declaration as required by § 1.63 must be filed. In those situations where a new oath or declaration is required due to additional subject matter being claimed, additional inventors may be named in the continuing application. In a continuation or divisional application which discloses and claims only subject matter disclosed in a prior application, no additional oath or declaration is required and the application must name as inventors the same or less than all the inventors in the prior application." 37 CFR 1.60(c) (dealing with the continuation situation).

(complete applicable item (a), (b) and/or (c) below)

- (a) ☐ This application discloses and claims only subject matter disclosed in the prior application whose particulars are set out above and the inventor(s) in this application are
- ☐ the same.
  - ☐ less than those named in the prior application. It is requested that the following inventor(s) identified for the prior application be deleted:

\_\_\_\_\_  
(type name(s) of inventor(s) to be deleted)

- (b) ☒ This application discloses and claims additional disclosure by amendment and a new declaration or oath is being filed. With respect to the prior application, the inventor(s) in this application are
- ☒ the same.
  - ☐ the following additional inventor(s) have been added:

\_\_\_\_\_  
(type name(s) of inventor(s) to be added)

- (c) The inventorship for all the claims in this application are
- ☒ the same.
  - ☐ not the same. An explanation, including the ownership of the various claims at the time the last claimed invention was made
    - ☐ is submitted.
    - ☐ will be submitted.

**21. Abandonment of Prior Application (if applicable)**

- ☒ Please abandon the prior application at a time while the prior application is pending, or when the petition for extension of time or to revive in that application is granted, and when this application is granted a filing date, so as to make this application copending with said prior application.

*NOTE: According to the Notice of May 13, 1983 (103, TMOG 6-7), the filing of a continuation or continuation-in-part application is a proper response with respect to a petition for extension of time or a petition to revive and should include the express abandonment of the prior application conditioned upon the granting of the petition and the granting of a filing date to the continuing application.*

**22. Petition for Suspension of Prosecution for the Time Necessary to File an Amendment**

**WARNING:** "The claims of a new application may be finally rejected in the first Office action in those situations where (1) the new application is a continuing application of, or a substitute for, an earlier application, and (2) all the claims of the new application (a) are drawn to the same invention claimed in the earlier application, and (b) would have been properly finally rejected on the grounds of art of record in the next Office action if they had been entered in the earlier application." MPEP, § 706.07(b).

*NOTE: Where it is possible that the claims on file will give rise to a first action final for this continuation application and for some reason an amendment cannot be filed promptly (e.g., experimental data is being gathered) it may be desirable to file a petition for suspension of prosecution for the time necessary.*

*(check the next item, if applicable)*

- ☐ There is provided herewith a Petition To Suspend Prosecution for the Time Necessary to File An Amendment (New Application Filed Concurrently)

**23. Small Entity (37 CFR § 1.28(a))**

- ☒ Applicant has established small entity status by the filing of a verified statement in parent application 60 / 054,846 on 08/06/97.
- ☐ A copy of the verified statement previously filed is included.

**WARNING:** "Status as a small entity in one application or patent does not affect any other application or patent, including applications or patents which are directly or indirectly dependent upon the application or patent in which the status has been established. Applications filed as continuations, divisions or continuations-in-part of a parent application must include a reference to a verified statement filed in the parent application if status as a small entity is still proper and desired." 37 CFR § 1.28(a).

**24. NOTIFICATION IN PARENT APPLICATION OF THIS FILING**

- ☐ A notification of the filing of this  
*(check one of the following)*
- ☐ continuation
  - ☐ continuation-in-part
  - ☐ divisional

is being filed in the parent application, from which this application claims priority under 35 U.S.C. § 120.

# COMPOSITION, METHOD, AND APPARATUS FOR PROTECTING PLANTS FROM INJURY CAUSED BY FROST OR FREEZING TEMPERATURES

5

## Cross-Reference to Related Application

This application claims benefit of U.S. Provisional Application Serial No. 60/054,846, filed August 6, 1997 which is directed to a composition and method for protecting plants from injury caused by frost or freezing temperatures.

10

## Background of the Invention

This invention relates to a protecting plants from injury due to frost or freezing and, more particularly, to a composition, method, and apparatus for protecting plants from injury caused by frost or freezing temperatures.

15

When plants are exposed to freezing conditions during the growing season, temporary or permanent injury to the plants is likely to occur. Such injury is one of the leading causes of loss in the agricultural industry. It has been estimated that from 5 to 15 percent of the gross world agricultural product is lost to frost damage in one year. According to one estimate, approximately 10 billion dollars of agricultural products are lost annually to plant and crop freezing world-wide each year.

20

Frost sensitive plants and fruits generally cannot tolerate ice formation within their tissues and break down and become flacid and discolored as the plant begins to warm. Typically, during a light freeze when temperatures range between -2C to 0C (29F/32F), tender plants are often killed or damage with little effect on other vegetation. During a

moderate freeze when temperatures range between -8C and -2C (25F to 28F), heavy damage will occur to most plants, including fruit blossoms and tender semi-hardy plants. During a severe freeze when temperatures drop below -9C (24F), heavy damage will occur to most plants.

5 Present methods of protecting vegetation from frost include warming the air surrounding the plants using heating devices, such as smudge pots, heat blowers and canopy heaters, placed near the plants; stirring the air over the plants by use of helicopters or air blowing equipment; and covering the plants with a insulating material such as water, fogs, material tarps, and foam sheeting material. Such methods of frost protection, however, are  
10 undesirable due to their tendency to pollute as in the case of heating devices, or are relatively expensive, as in the case of utilizing wind blowing devices or helicopters, or are relatively labor intensive as in the case of utilizing tarps or foam sheeting materials. Further, such frost protection devices often achieve limited success, particularly when the ambient air temperature falls well below freezing for a substantial amount of time or during windy  
15 conditions.

In addition to such physical methods, various chemical methods have been developed and used for reducing or preventing injury to vegetation caused by frost or freezing temperatures. Such methods include applying various chemical compounds onto the plants to be protected to lower the temperature at which plant damage occurs. Such chemical  
20 methods, however, tend to be unreliable, relatively expensive, and ecologically specious.



Accordingly, a need exists for a composition, method, and apparatus of protecting plants from injury caused by frost or freezing temperatures which is relatively inexpensive, environmentally acceptable, non-toxic, ecologically sound, and is not labor intensive.

### **Summary of the Invention**

5           The present invention is directed to a composition and method for producing a relatively stable insulating foam, and a method and apparatus for applying the insulating foam to the surface of plants and crops for effectively hindering or reducing injury to the plants caused by frost or freezing temperatures.

          In a preferred embodiment of the invention, the composition comprises a vegetable  
10 oil, and a foaming agent and/or stabilizer for producing a relatively stable insulating foam.

          In another preferred embodiment of the invention, the composition comprises a vegetable oil, an emulsifier, and a foaming agent to form a pre-emulsion concentrate which can be mixed with water to form an oil-in-water emulsion which is effective for producing a relatively stable insulating foam.

15           In another preferred embodiment of the invention the vegetable oil is selected from the group comprising coconut oil, corn oil, cottonseed oil, palm oil, rapeseed oil, and sunflower oil.

          In another preferred embodiment of the invention the vegetable oil is a soya oil.

          In another preferred embodiment of the invention the vegetable oil is a crude, non-

refined vegetable oil.

In another preferred embodiment of the invention the vegetable oil is a crude, non-refined soya oil.

In another preferred embodiment of the invention, the composition of the present invention comprises an alkyl alcohol ethoxylate emulsifier.

In another preferred embodiment of the invention, the composition of the present invention comprises a foam stabilizer.

In another preferred embodiment of the invention, the composition of the present invention comprises a thickener.

In another preferred embodiment of the invention, the composition of the present invention may be used as a crop adjuvant,

In another preferred embodiment of the invention, the composition of the present invention comprises a plant growth regulator.

In another preferred embodiment of the invention, the composition of the present invention comprises a pesticide.

In another preferred embodiment of the invention, the foaming agent of the present invention comprises neutralized alkyl sulfate and triethanolamine.

In another preferred embodiment of the invention, the foaming agent of the present invention comprises an amine oxide.

In another preferred embodiment of the invention, the foaming agent of the present

invention comprises a quaternary ammonium compound.

In another preferred embodiment of the invention, the foaming agent of the present invention comprises an alkyl alcohol.

5 In another preferred embodiment of the invention, the foaming agent of the present invention comprises an aryl alcohol.

In another preferred embodiment of the invention, the foaming agent of the present invention comprises a hydrolyzed protein.

In another preferred embodiment of the invention, the foaming agent of the present invention comprises oxyalkylates.

10 In another preferred embodiment of the invention, the foaming agent of the present invention comprises neutralized alkyl sulfates.

In another preferred embodiment of the invention, the foaming agent of the present invention comprises neutralized alkyl and aryl sulfonates.

15 In another preferred embodiment of the invention, the foam stabilizer of the present invention comprises a carboxyalkylcellulose.

In another preferred embodiment of the invention, the thickener of the present invention comprises a mucilage.

In another preferred embodiment of the invention, the growth regulator of the present invention comprises an ethylene.

20 In another preferred embodiment of the invention, the pesticide of the present

invention comprises malathion.

In another preferred embodiment of the invention, the pesticide of the present invention comprises mineral oil.

In a preferred embodiment of the invention, the composition of the present invention  
5 comprises methylated silica polydimethylsiloxane.

In another preferred embodiment of the invention, the composition of the present invention is stored in a manner whereby the foam concentrate is stored a holding tank in flow communication with a water source.

In another preferred embodiment of the invention, the composition of the present  
10 invention is aerated by a method and apparatus to produce a foam which is sprayed or deposited onto the surface of the plant to be protected to form an insulating foam layer or blanket.

In another preferred embodiment of the invention, the method and apparatus to aerate the composition of the present invention is by means of a nozzle having means for  
15 inducing air into the composition.

In another preferred embodiment of the invention, the composition is deposited onto plants by means of a pressurized container.

A primary object of this invention, therefore, is to provide a composition, method and apparatus of preventing or reducing injury to plants caused by frost or freezing  
20 temperatures.

Another primary object of this invention is to provide a method and apparatus for spraying plants with an insulating foam.

Another primary object of this invention is to provide a pre-emulsion concentrate which is stable and does not separate during storage.

5        Another primary object of this invention is to provide a pre-emulsion concentrate which can be mixed with water to form an oil-in-water emulsion.

Another primary object of this invention is to provide an insulation foam for protecting plants from injury caused by frost or freezing temperatures.

10       Another primary object of this invention is to provide a composition for protecting plants from injury caused by frost or freezing temperatures which is non-toxic.

Another primary object of this invention is to provide a composition for protecting plants from injury caused by frost or freezing temperatures which is ecologically acceptable.

15       Another primary object of this invention is to provide a composition and method of protecting plants from injury caused by frost or freezing temperatures which is relative inexpensive.

Another primary object of this invention is to provide a composition and method of protecting plants from injury caused by frost or freezing temperatures which applies relatively easily and in a relatively short amount of time.

20       Another primary object of this invention is to provide a composition which can be used as a crop adjuvant to assist in the adhesion and spreading of growth regulators and/or pesticides.

These and other objects and advantages of the invention will be apparent from the following drawings and detailed description of the preferred embodiments.

**Brief Description of the Drawings**

**FIG. 1** is a schematic representation of a foam dispensing apparatus of the present invention showing a system for spraying and covering plants with the insulating foam of the present invention;

**FIG. 2** is a side view, partially broken, showing in more detail the foam forming nozzle assembly of the foam dispensing apparatus of **FIG. 1**;

**FIG. 3** is a schematic representation of another embodiment of a foam dispensing apparatus of the present invention showing another system for spraying and covering plants with the insulating foam of the present invention comprising additional supply tanks;

**FIG. 4**, is another embodiment of a foam dispensing apparatus of the present invention showing another system for spraying and covering plants with the insulating foam of the present invention having water supplied through a hose and the pre-emulsion concentrate being drawn into the water stream by aspiration or by pressure and discharged as foam through the nozzle; and

**FIG. 5** is another embodiment of a foam dispensing apparatus of the present invention showing another system for spraying and covering plants having a pressurized cylinder having a spray nozzle and containing the foam concentrate of the present invention and a gas propellant.

### **Detailed Description of Preferred Embodiments**

The present invention for protecting plants from injury caused by frost or freezing temperatures comprises an insulating foam effective for providing a blanket or insulating layer along the surface of the plants to be protected. The insulating foam is produced from  
5 a composition comprising a vegetable oil and a foaming agent. Preferably, the vegetable oil comprising the insulating foam is soya oil, however, other suitable vegetable oils include coconut oil, corn oil, cottonseed oil, palm oil, rapeseed oil, and sunflower oil. In addition, the vegetable oil is preferably a crude, non-refined or nonpurified oil. It should now be apparent to one skilled in the art that the use of a crude, non-refined vegetable oil as a base  
10 component will be significantly less expensive than using a refined or a purified vegetable oil. Further, crude vegetable oils, especially crude soya oil, contain tocopherol which is a natural antioxidant and functions as a preservative. This permits the foam producing composition to be stored for use without or with the use of significantly less additional preservatives. Crude vegetable oils also contain gums which improve the oil's stickability  
15 or adhesion characteristics thereby increasing the ability of the foam to cling to the plant's surfaces. In this way, the composition may also be used as an adjuvant to assist in the adhesion and spreading of growth regulators such as ethylene, and pesticides such as mineral oil and malathion.

The insulating foam is produced from a composition comprising an oil and water  
20 emulsion prepared from a pre-emulsion concentrate using an emulsifier which is suitable for providing a stable oil and emulsifier composition having a relatively large percentage of

vegetable oil. One problem with producing a foam which is effective for providing protection for a plant from injury caused by frost or freezing temperatures is the difficulty of providing a stable oil and emulsifier composition having a relatively large percentage of vegetable oil. This is particularly true for compositions comprising crude, non-refined vegetable oils. Emulsifiers which have been found to be particularly suitable include alkyl, aryl or glycol ethoxylate, propoxylate, butoxylate or sulfonate-based emulsifiers.

One emulsifier which has been found to be particularly effective for producing a stable pre-emulsion concentrate comprising crude, nonpurified or nonrefined soya oil comprises a 3 mole ethylene oxide adduct of C12 and C14 alcohols. In formulating the emulsifier, about 30% to about 50% by weight of C12 alcohol is first mixed with about 50% to about 70% C14 alcohol. The C12 and C14 alcohols are then ethoxylated with 3 moles of ethylene oxide to produce the desired emulsifier.

In another preferred embodiment of the invention, it was unexpectedly found that the use of a silicone compound typically used for food systems, such as a methylated silica polydimethylsiloxane, such as sold by Dow Corning under the name Anti Foam 1500, may be used to produce a stable and relatively tight foam. Such a composition may be particularly suited for use for providing an insulating foam utilizing a pressurized container or a container using a propellant such as an inert gas or air.

Suitable foaming agents such as quaternary ammonium compounds, amine oxides, neutralized alkyl sulfates, neutralized alkyl and aryl sulfonates, hydrolyzed protein, alkyl and aryl alcohols, and oxyalkylates may be used in the composition of the present invention.



Foam thickeners and stabilizers such as carboxyalkylcellulose and mucilage may also be used in the composition. Emulsifying agents may be used as foam thickeners and foam stabilizers and may also be used as emulsifiers to produce a stable pre-emulsion concentrate for storage purposes as well as to produce a stable foam.

- 5           In a preferred embodiment of the present invention, the composition effective for producing a stable foam concentrate is prepared by mixing about 40% to about 90% by weight of a crude, nonpurified or nonrefined vegetable oil with about 1% to about 40% by weight of an emulsifier, and about 0.5% to about 10% sodium lauryl sulfate and about 0.5% to about 10% triethanolamine. The composition may be stored until ready to use or shipped
- 10       to the ultimate customer for use.

In order to further illustrate the invention, the following specific example of a composition for preventing or hindering injury to plants caused by frost or freezing temperatures were prepared:

#### **EXAMPLE 1**

- 15           A composition for preventing or hindering injury to plants caused by frost or freezing temperatures was prepared by mixing together by agitation a crude, nonpurified or nonrefined soya oil with an emulsifier comprising a 3 mole ethylene oxide adduct of C12 and C14 alcohols in a 500 gallon mixing vessel. The following quantities were used to produce the desired composition resulting in a stable and relatively tight insulating foam:

| <u>Material</u> | <u>Volume (gal)</u> | <u>Vol (%)</u> | <u>Weight (lbs)</u> | <u>Wt (%)</u> |
|-----------------|---------------------|----------------|---------------------|---------------|
| Crude soya oil  | 400.0               | 85.0           | 3120.0              | 85.2          |
| Emulsifier      | 71.0                | 15.0           | 543.2               | 14.8          |
| 5               | _____               | _____          | _____               | _____         |
|                 | 471.0               | 100.0          | 3663.2              | 100.0         |

Agitation was provided by a 3.5 Horsepower pump. The composition was pulled from the bottom of the mixing vessel, sheared and moved by the pump through a 1.5 inch diameter hose, returned through the top of the vessel to fall back into the composition remaining in the vessel. The emulsifier was added slowly through the top of the vessel over a 30 minute period during agitation. Foam was formed on top of the composition in the vessel and began to accumulate. 15 grams of methylated silica polydimethylsiloxane, sold under the name Antifoam 1500 by the Dow Corning Company was added to the composition and agitation was continued. Unexpectedly, the Antifoam 1500 resulted in a more stable and tighter foam.

The insulating foam layer or blanket for hindering or preventing injury to plants caused by frost or freezing displayed surprising characteristics. After about ten hours, the foam formed by the composition of the present invention continued to be stable and had not broken. In addition, the foam layer appeared to have caused no detrimental effects to the plants.

## EXAMPLE 2

A composition for preventing or hindering injury to plants caused by frost or freezing temperatures was prepared by mixing together by agitation a crude, nonpurified or nonrefined soya oil with an emulsifier comprising a 3 mole ethylene oxide adduct of C12 and C14 alcohols. The following ratio was used for quantities to produce the desired pre-emulsion concentrate:

|    | <u>Material</u>       | <u>Weight (%)</u> |
|----|-----------------------|-------------------|
|    | Crude soy oil         | 75.0              |
|    | Emulsifier            | 20.0              |
| 10 | Sodium Lauryl Sulfate | 3.0               |
|    | Triethanolamine       | 2.0               |

Agitation was provided by a lab blender (3200 rpm) at 35 degrees C to produce 200 grams of the concentrate.. The pre-emulsion concentrate was then mixed with water to produce 3% and 9% solutions which were pumped through a aerating nozzle to produce a relatively stable and tight foam. The foam was then applied to leaves of a young tomato plant to produce an insulating layer or blanket. After five hours the foam remained relatively stable and appeared to produce no harmful effects to the tomato plant.

As previously described, the composition of the present invention comprises a relatively inexpensive, environmentally acceptable, non-toxic, and ecologically sound foam which is effective for hindering or preventing plants from injury caused by frost or freezing temperatures.

Referring to **FIG. 1**, a schematic representation of a preferred embodiment of a foam dispensing apparatus, generally designated **100**, of the present invention is shown illustrating a foam dispensing system for spraying and covering plants with a blanket of insulating foam. The foam dispensing apparatus **100** comprises a pre-emulsion concentrate storage tank **102** having an outlet **104**, and a water supply **106** having an outlet **108**. The storage tank **102** and a conventional water supply **106** are both in fluid communication with a foam forming nozzle assembly **110** through a system of conduits, generally designated **112**. In operation, the pre-emulsion concentrate of the invention is directed out of the outlet **104** of the pre-emulsion concentrate storage tank **102** and through conduit **114** to a mixer **116**. Water, which has been directed to the mixer **116** from the water supply **106** through outlet **108** and conduit **118**, is mixed with the pre-emulsion concentrate to form an oil and water emulsion. A fluid pump **120**, powered by a conventional electric or gasoline powered motor **122**, is provided to pump the oil and water emulsion to the foam forming nozzle assembly **110**. It should be apparent to one skilled in the art that the pump **120** must provide sufficient pressure to blow and produced a foam spray **F** which can be directed onto the plants to be protected. It should also now be apparent that the required pressure is dependent on the number and size of the nozzles, the distance to blow, the length and diameter of the conduits, the coverage necessary, and the concentration of the oil and water emulsion. The pressure necessary for any particular application may be easily determined by one skilled in the art.

The pump **120** includes an inlet **124** connected to the mixer **116** through conduit **126**

and an outlet **128** which is connected to the foam forming nozzle assembly **110** through conduit **130**. The outlet **104** of the pre-emulsion concentrate storage tank **102** and the outlet **108** of the water supply **106** are each provided with a valves **132** and **134**, respectively, for adjusting the amount of water and pre-emulsion concentrate entering the  
5 mixer **116**. By adjusting the oil and water emulsion, the density of the foam can be regulated to meet the specific insulating need of the crop or plant. For example, by increasing or decreasing the ratio of the pre-emulsion concentrate and water, the density of the foam can be increased or decreased.

The foam forming nozzle assembly **110** for producing and spraying a foam whereby  
10 plants may be covered with an insulating blanket of foam is designed to inject or draw air into the oil and water emulsion and to direct the foam spray to the area of the plants and crops to be protected. Depending on the application, the foam forming nozzle assembly **110** may also be conventionally designed to atomize the oil and water emulsion to improve aspiration. Referring to **FIG. 2**, a preferred embodiment of a foam forming nozzle assembly  
15 **110** is illustrated comprising a cylindrical member **136** having an inlet **138** for receiving the oil and water emulsion through conduit **130** and an outlet **140** for discharging a foam spray **F**. The cylindrical member **136** is provided with a plurality of lateral air inlets **142** through which air is drawn into the oil and water emulsion stream **S** to form the insulating foam spray **F**.

20 It should be apparent to one skilled in the art that other foam dispensing apparatus using various systems may be used to form and distribute the foam of this invention across

the surfaces of plants. While the foam dispensing apparatus disclosed herein illustrate and describe specific systems which may be utilized to dispense and apply foam to plants, the disclosure of such foam dispensing apparatus and systems is only an exemplification of the principals for applying a foam blanket on plants and is not intended to limit the invention to the particular foam dispensing apparatus or systems illustrated and described. For example, foam dispensing apparatus may be conventionally designed for a system which is placed within the bed of a truck or a trailer to be transported through a field. In addition, as shown in **FIG. 3**, the foam dispensing apparatus may include additional tanks **144** containing various types of chemicals, including herbicides, fungicides, fertilizers, insecticides and the like, to permit the foam produced by this invention to operate as a carrier. It has been found that the tacky nature of the foam produced by this invention has shown the foam to be an excellent crop adjuvant to assist in the adhesion and spreading of growth regulators and/or pesticides. Hand held systems having foam dispensing apparatus, such as shown in **FIG. 4**, may include hose-end dispenser devices whereby water is supplied through a hose **146** and the pre-emulsion concentrate is drawn from a holding container **148** into the water stream **S** through a hose **150** by aspiration or by pressure and mixed with the water stream **S** and discharged as foam through the nozzle **152**. Another foam dispensing apparatus is shown in **FIG. 5** comprising a pressurized cylinder **154** and a spray nozzle **156**. Contained within the pressurized cylinder **154** is the foam concentrate of the present invention **158**, such as previously shown in Example 1, and a gas propellant **160** for expelling the concentrate out through conduit **162** and spray nozzle **156** which

forms the insulating foam F.

It should also now be apparent to one skilled in the art that the systems using foam producing apparatus, such as previously described, may include the use of a plurality of foam producing nozzles or require such nozzles to be mounted on various devices such as poles, booms, elongated manifolds and the like to permit effective plant coverage.

It should also now be apparent to one skilled in the art that the foam dispensing apparatus can easily be incorporated into existing or conventional crop spraying systems which are supplied with or may be equipped with air aspiration nozzles.

There has thus been provided a novel composition and method for producing a relatively stable insulating foam and an apparatus and a method of applying the insulating foam to the surface of plants and crops for effectively hindering or reducing injury to plants and crops caused by frost or freezing temperatures. The composition of the present invention is relatively inexpensive, environmentally acceptable, ecologically sound, nontoxic, and should have no detrimental effects on plant life or development. In fact, it has been found that the use of the vegetable oil of the present invention operates effectively as a pesticide to reduce insect damage. It has also been found that the tacky nature of the foam produced by this invention allows the foam to be used as a crop adjuvant.

Although this invention has been shown and described with respect to detailed embodiments thereof, it will be understood by those skilled in the art that various changes in form and detail thereof may be made without departing from the basic principles, spirit, and scope of the claimed invention.

We claim:

CLAIMS

1. A composition for producing a foam for use in protecting plants against frost or freezing temperatures comprising:
  - a vegetable oil;
  - an emulsifier; and
  - a foaming agent.
2. The composition of Claim 1 further comprising water.
3. The composition of Claim 1 wherein the vegetable oil is a crude vegetable oil.
4. The composition of Claim 3 wherein said emulsifier comprises a compound of silicone.
5. The composition of Claim 4 wherein said compound of silicone is a methylated silica polydimethylsiloxane.



6. The composition of Claim 1 wherein the vegetable oil is selected from the group comprising of coconut oil, corn oil, cottonseed oil, palm oil, rapeseed oil, soya, and sunflower oil.
7. The composition of Claim 1 wherein said emulsifier is an alkyl alcohol ethoxylate.
8. The composition of Claim 1 wherein said foaming agent comprises neutralized alkyl sulfates.
9. The composition of Claim 1 wherein said foaming agent comprises neutralized alkyl sulfonates.
10. The composition of Claim 1 wherein said foaming agent comprises neutralized aryl sulfonates.
11. The composition of Claim 1 wherein said foaming agent comprises neutralized alkyl sulfate and triethanolamine.

12. The composition of Claim 1 wherein said foaming agent comprises an amine oxide.
13. The composition of Claim 1 wherein said foaming agent comprises a quaternary ammonium compound.
14. The composition of Claim 1 wherein said foaming agent comprises an alkyl alcohol.
15. The composition of Claim 1 wherein said foaming agent comprises aryl alcohol.
16. The composition of Claim 1 wherein said foaming agent comprises hydrolyzed protein.
17. The composition of Claim 1 wherein said foaming agent comprises oxyalkylates.
18. The composition of Claim 1 further comprising a carboxyalkylcellulose as a foam stabilizer.

19. The composition of Claim 1 further comprising a mucilage as a thicker.
20. The composition of Claim 1 further comprising a growth regulator.
21. The composition of Claim 20 wherein said growth regulator comprises an ethylene.
22. The composition of Claim 1 further comprising a pesticide.
23. The composition of Claim 22 wherein said pesticide comprises malathion.
24. The composition of Claim 22 wherein said pesticide comprises mineral oil.

25. A composition for producing a foam for use in protecting plants against frost or freezing temperatures comprising:

a pre-emulsion concentrate comprising a crude vegetable oil, an emulsifier, and a foaming agent; and

water;

wherein said crude vegetable oil is selected from the group comprising soya oil, coconut oil, corn oil, cottonseed oil, palm oil, rapeseed oil, and sunflower oil

wherein said emulsifier is selected from the group comprising alkyl, aryl, or glycol ethoxylate, propoxylate, butoxylate or sulfonate based emulsifiers; and

wherein said foaming agent is selected from the group comprising quaternary ammonium compounds, amine oxides, neutralized alkyl sulfates, neutralized alkyl and aryl sulfonates, hydrolyzed protein, alkyl alcohol, aryl alcohol, and oxyalkylates.

26. The composition of Claim 25 wherein said emulsifier comprises a 3 mole ethylene oxide adduct of C12 and C14 alcohols.

27. The composition of Claim 25 wherein said emulsifier comprises about 30% to about 50% by weight of C12 alcohol and about 50% to about 70% C14 alcohol and wherein said C12 alcohol and said C14 alcohol are ethoxylated with 3 moles of ethylene oxide.
28. The composition of Claim 25 wherein said composition further comprises sodium lauryl sulfate and triethanolamine.
29. The composition of Claim 25 wherein said composition further comprises a foam stabilizer and thickener selected from the group comprising carboxyalkylcellulose and mucilage.
30. The composition of Claim 25 further comprises a growth regulator.
31. The composition of Claim 25 further comprising a pesticide.

32. The composition of Claim 25 wherein said pre-emulsion concentrate comprises about 75% by weight of soya oil; about 20% by weight of said emulsifier comprising 3 mole ethylene oxide adduct of C12 alcohol and C14 alcohol; about 3% by weight of sodium lauryl sulfate; and about 2% by weight of triethanolamine.

33. A method of protecting plants from frost or freezing temperatures comprising the steps of:  
producing a pre-emulsion concentrate comprising a vegetable oil, an emulsifier and a foaming agent;  
mixing the pre-emulsion concentrate with water to form an oil and water emulsion;  
aerating the oil and water emulsion to form a foam; and  
applying the foam to the plants.

34. An apparatus for dispensing a foam over the surfaces of plants comprising:  
means for storing a pre-emulsion concentrate;  
means for mixing said pre-emulsion concentrate with water to form an oil and water emulsion;  
means for aspirating said oil and water emulsion to form a foam; and  
means for directing said foam onto the surface of a plant.

**ABSTRACT**

The present invention is directed to a composition, method, and apparatus for protecting plants from injury caused by frost or freezing temperatures by applying an insulating foam to the surface of plants. Plants are sprayed with a foam formed from a pre-emulsion concentrate comprising a vegetable oil, an emulsifier, and a forming agent. The pre-emulsion concentrate is mixed with water and aerated to form a foam. The foam is then directed onto the surfaces of the plant to be covered.

FIG. 1

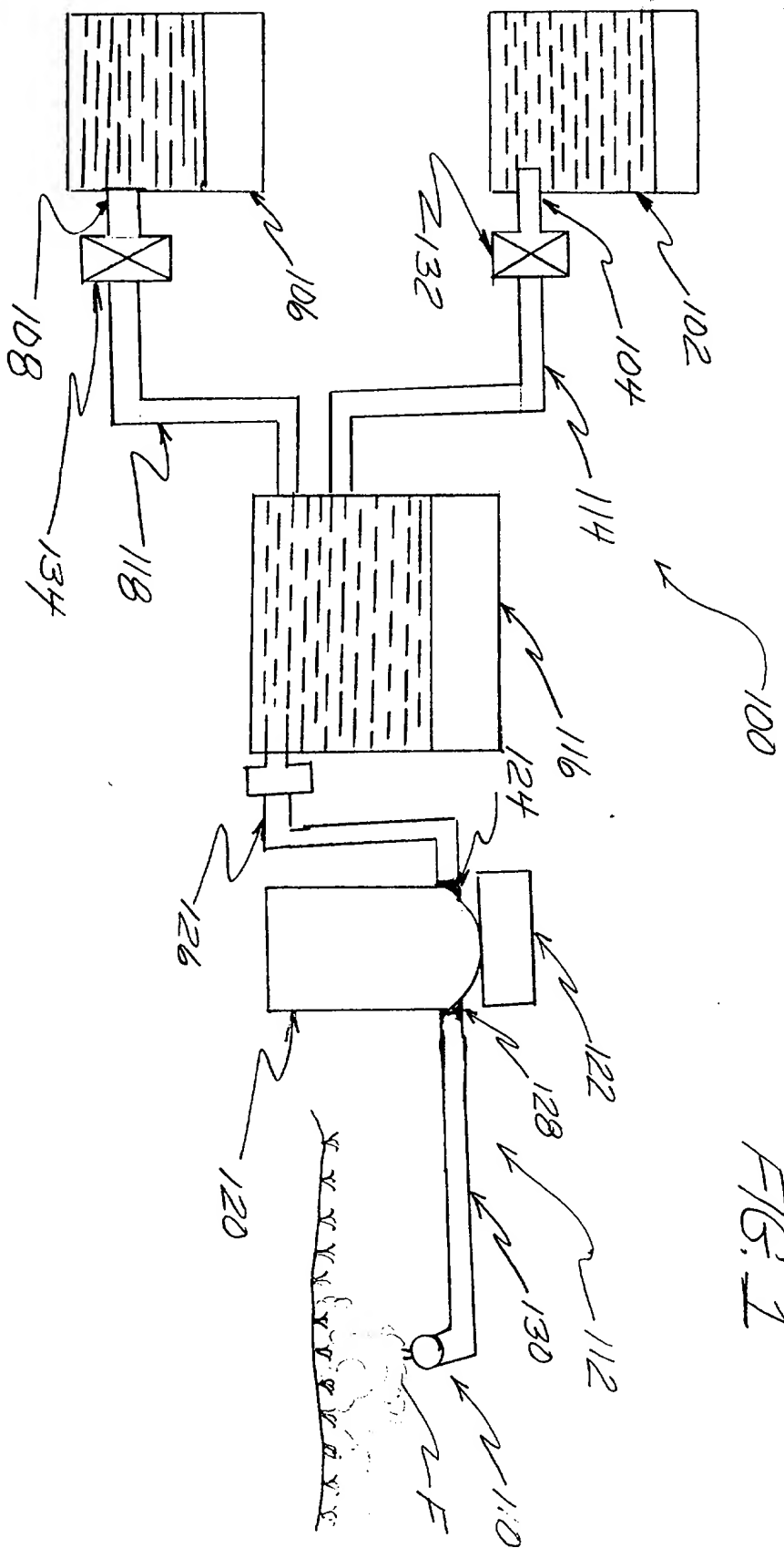
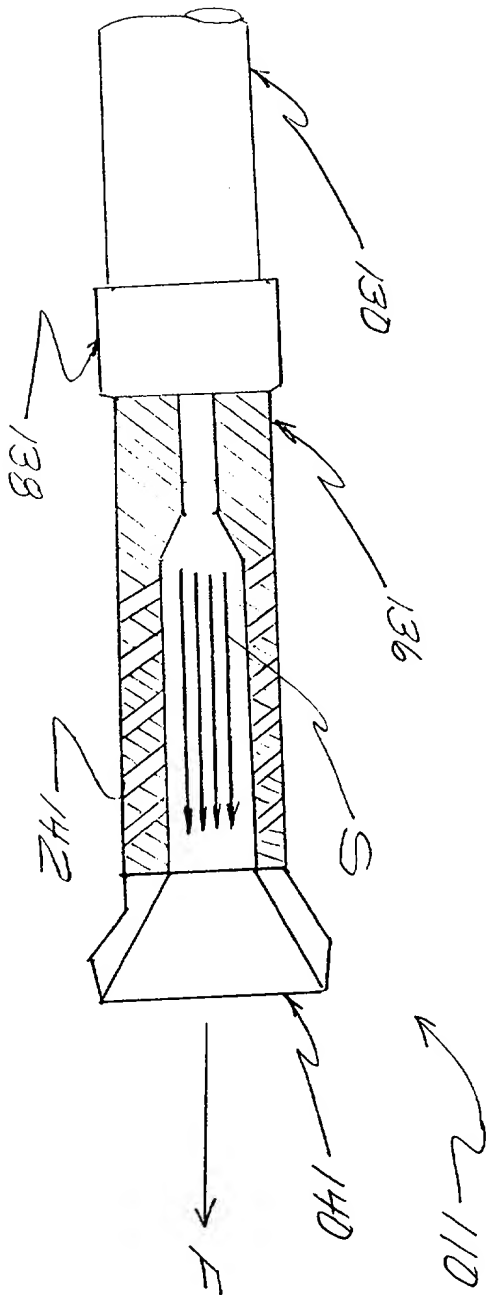




FIG. 2



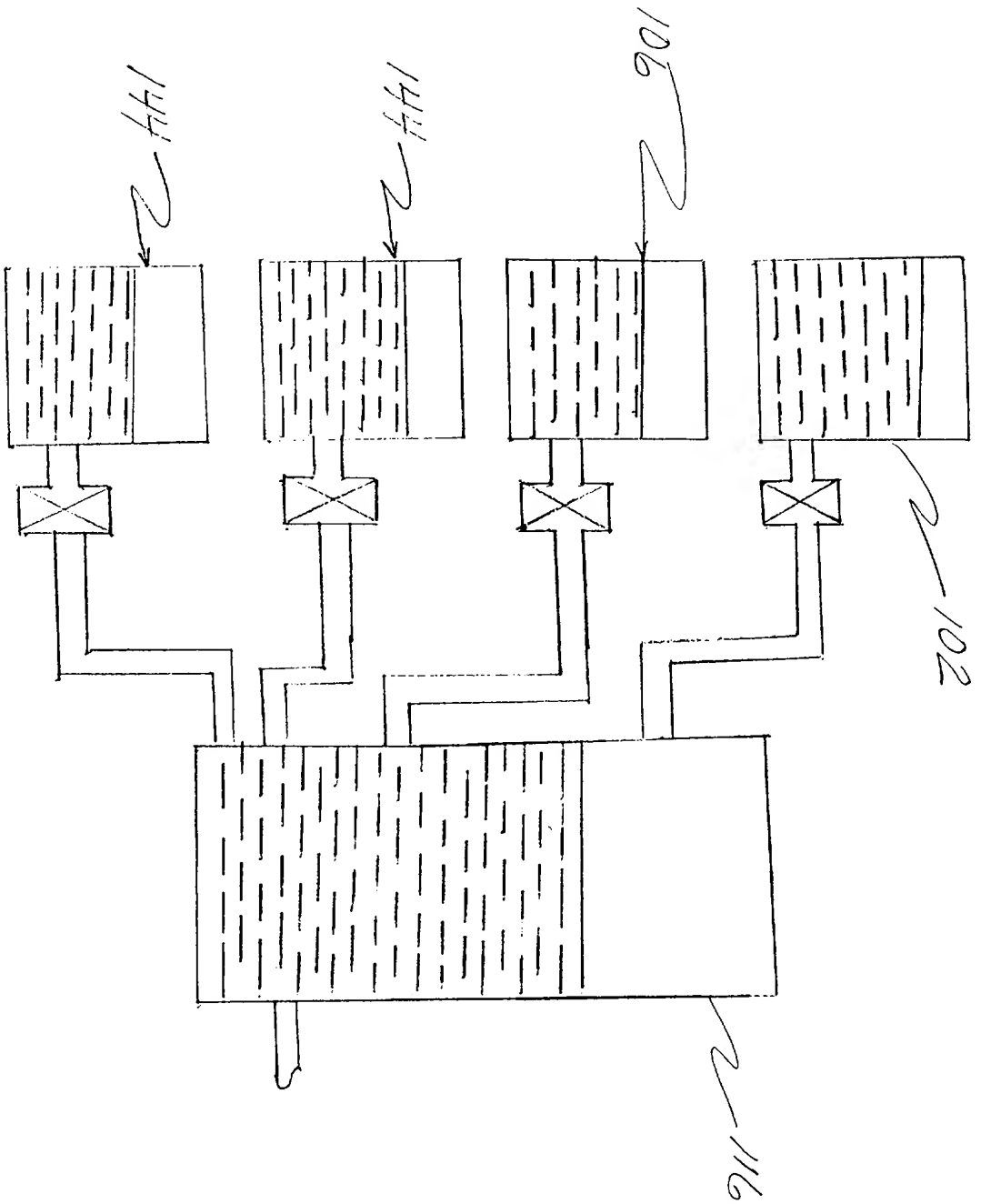


FIG. 3

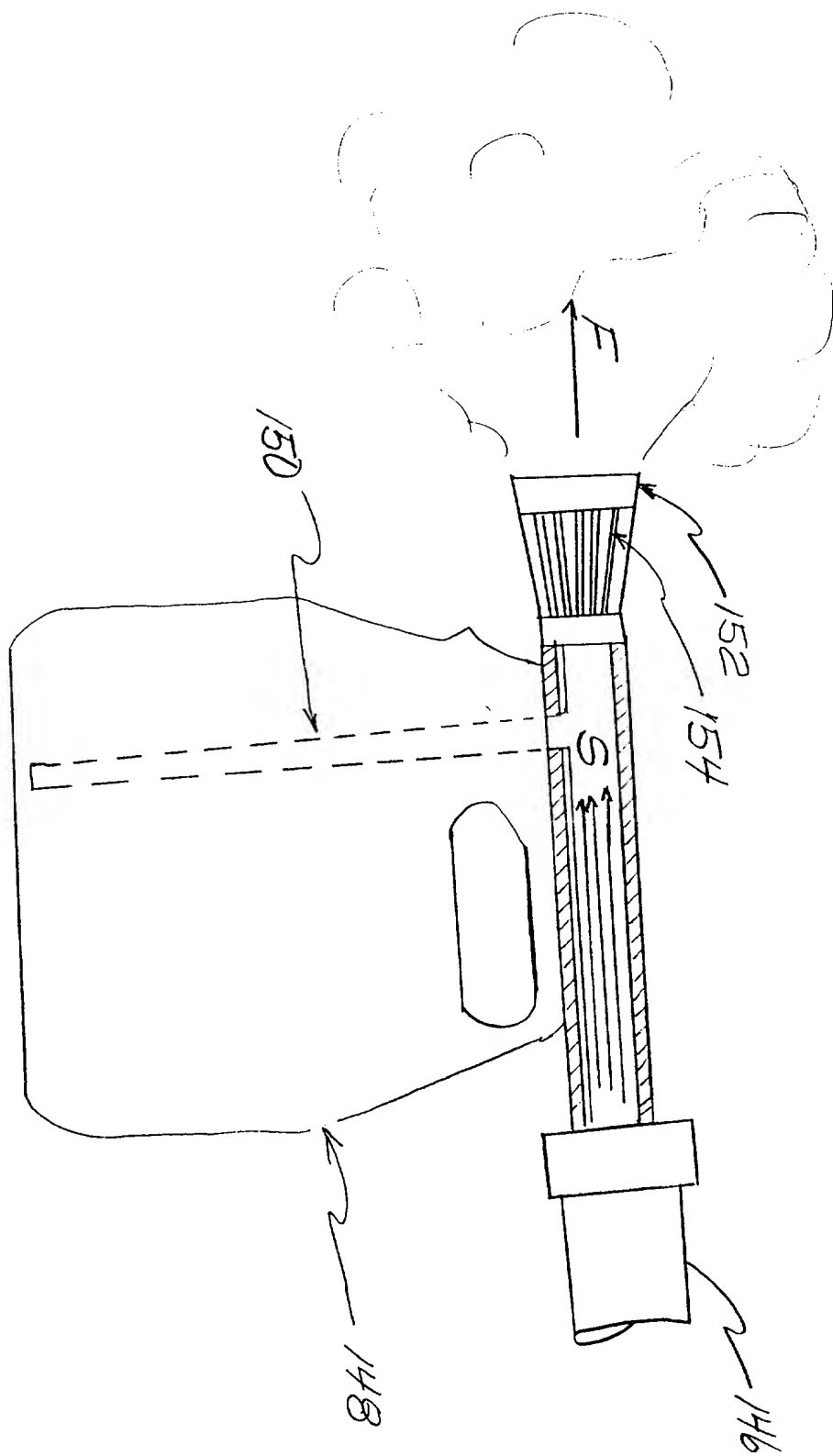
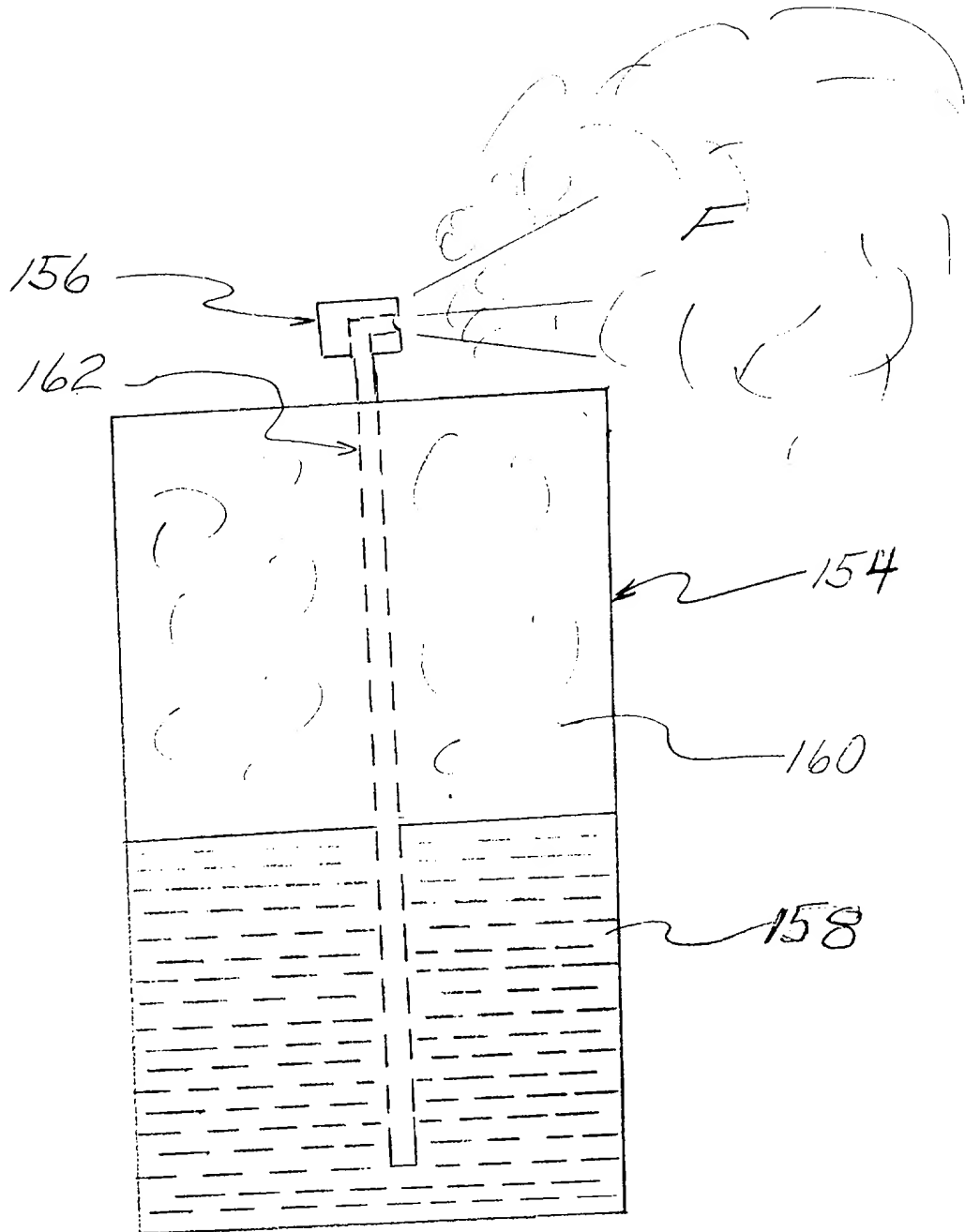


FIG. 5



## PATENT

### COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that: my residence, post office address and citizenship are as stated below, next to my name; that I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter that is claimed, and for which a patent is sought on the invention entitled:

**COMPOSITION, METHOD, AND APPARATUS FOR PROTECTING PLANTS FROM INJURY CAUSED BY FROST OR FREEZING TEMPERATURES** the specification of which

is attached hereto; that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above; that I acknowledge the duty to disclose information, which is material to patentability as defined in 37, Code of Federal Regulations, Section 1.56, and which is material to the examination of this application, namely, information where there is a substantial likelihood that a reasonable Examiner would consider it important in deciding whether to allow the application to issue as a patent; that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

### POWER OF ATTORNEY

I hereby appoint the following attorneys to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: Mark F. Smith (Reg. No. 32,437), George P. Brandenburg (Reg. No. 30,031), and Ronald E. Greigg (Reg. 31,517). Send all correspondence to:

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Combined Declaration and Power of Attorney  
Page 2

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